DESIGN AND ANALYSIS OF LEAF SPRING USING COMPOSITE MATERIAL

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***Abstract*— In this study, design and static analysis of carbon/epoxy composite mono leaf spring was done by comparing the conventional steel leaf spring which is used by existing spring a four wheeled light vehicle. The main idea behind this work is to replace the existing steel leaf spring material with a mono laminated carbon/epoxy composite leaf spring with same width, thickness and load carrying capacity. In this study, the main investigation of the study is to reduce the weight of product while upholding its strength. Then to solve problem in this regard composite materials are play an important role. The prominence of the paper was to design and analysis of quasi isotropic laminated carbon/epoxy composite material leaf spring suspension system. Then this study seeks to address, improve load carrying capacity and designing less stressed, less deformed and light weight composite leaf spring, which have better performance than that of the existing steel leaf spring. The composite material which is carbon fiber .**

I. INTRODUCTION

Leaf springs (flat springs) made from flat plates which are called leaves. The leaves are usually given as initial curvature or cambered, so that they will tend to straighten when the load is applied. And the leaves are held together by a means of a band shrunk around them at the center or by a means of bolt, passing through the center of it. Since the band exerts stiffening and strengthening effect, therefore the effective length of the spring for bending will be overall length of spring minus width of the band. And again in case of a center bolt two third distance of U-bolt should be subtracted from the overall length of the spring in order to find effective length of the leaf spring . Leaf springs are mounted on the axle of the vehicle by using a U-bolt. The leaf spring has two eyes which are front and rear eye, the front eye is found at the front end of the master leaf and the rear eye which is found at the rear end of the master leaf of the leaf spring. The front end of the spring is connected to the frame with a simple pin joint, while the rear end of the spring is connected with a shackle. Shackle is the flexible link which connects between leaf spring rear eye and frame. When the vehicle comes across a projection on the road surface, the wheel moves up, this leads to deflecting the spring. This changes the length between the spring eyes. The advantage of leaf spring over helical spring is that the ends of the spring may be guided along a definite path as it deflects to act as a structural member in addition to the energy absorbing device. Thus leaf spring may carry lateral loads, brake torque, driving torque, in addition to the shocks. The ability to absorb and store more amount of energy ensures the comfortable operation of a suspension system. However, the problem of heavy weight of spring is still persistent.

Now a day suspension system of any vehicles contains leaf spring to absorb jolts. But it is observed that the failure of steel leaf springs is usually catastrophic . Then in order to reduce accidents, which comes through such failures conventional steel leaf spring can be replaced with gradually failing composite leaf springs. By doing this, the weight of the vehicle and fuel consumption may also be reduced while maintaining the strength of the leaf spring.

It is well known, the conventional steel leaf springs are all meets the basic requirement of strength and functionality, but the current Lightweight composite materials gives several advantageous over the current conventional steel leaf spring. This is because composite materials offer significant opportunities for enhancement of product performance in terms of strength, stiffness, life span and energy absorption, combined with weight reduction and space saving.

II. PROBLEM DEFINITION

System under Study

In order to investigate the applicability of proposed leaf spring used in suspension system. Conventionally used spring material springs are generally manufactured from plain carbon steel or simply carbon steel. Carbon steel has properties mainly due to its carbon content and does not contain more than 0.5% of silicon and 1.5%of manganese. The plain carbon steels

varying from 0.06% carbon to 1.5% carbon are divided into following types depending upon the carbon content.

1. Dead mild steel
2. Low carbon or mild steel.
3. Medium carbon steel.
4. High carbon steel

l. Carbon steels which are used for spring materials have following properties useful for spring materials:

a) Allowable shear stress: 420 MPa (average service)

b) Modulus of rigidity G: 80 kN/mm2

c) Modulus of elasticity E: 210 kN/mm

After studying the properties of various materials which make them suitable for manufacturing springs.

III. OBJECTIVES

Composite materials are those materials which are light in weight and has good stiffness properties along with some additional beneficial properties like corrosion resistance and it can also withstand high temperature. But manufacturing composite materials is very costly. So, these materials can be utilized only if the efficiency of the vehicle can be increased to such an extent that the cost of the material can be overcome.

Objectives can be summarized as follows

1. To know the different parameters which affect design of helical compression spring
2. To know the F.E.A. approach applied to design of spring
3. To decrease the weight of the spring BY using composite material
4. To increase the stiffness of the spring with lesser mass of material by using different composite material
5. To obtain additional advantages like corrosion resistance, non-conductance to heat and electricity.
6. Hence the objective of this project is to carry out designing of spring with a light weight composite materials.

IV. CONCLUSION

Because of the combinational use of composite material with steel, the overall weight of the system also reduced. Therefore the light weight system is achieved. So it will help to increase the fuel efficiency of automobiles. The cost of the overall system is higher than conventional system but because of the other advantages, it can be considerable. For special purpose applications, this system is very much efficient.

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